

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Chen et al.	Art Unit	: 1792
Serial No.	: 10/732,966	Examiner	: Sylvia R. MacArthur
Filed	: December 10, 2003	Conf. No.	: 9309
Title	: RETAINING RING WITH SLURRY TRANSPORT GROOVES		

Mail Stop Appeal Brief - Patents

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

BRIEF ON APPEAL

(1) Real Party in Interest

Applied Materials, Inc. is the real party in interest.

(2) Related Appeals and Interferences

None.

(3) Status of Claims

Claims 6, 10, and 12 have been cancelled. Claim 1-5, 7-9, 11, and 13-22 are pending, stand rejected, and are presently appealed.

(4) Status of Amendments

Amendments to claims 1, 19, and 20 submitted on March 12, 2009 have been entered.

(5) Summary of Claimed Subject Matter

Claim 1 is directed to a retaining ring (e.g. retaining ring 100) including a generally annular body (specification, page 4, lines 1-9, FIGS. 1, 3). The annular body has a top surface (e.g. surface 118), a bottom surface (e.g. surface 112), an inner diameter surface (e.g. surface 114), and an outer diameter surface (e.g. surface 116). The bottom surface includes a plurality of channels (e.g. grooves 130; specification, page 4, lines 12-18). Each channel extends from the inner diameter surface to the outer diameter surface (specification, page 4, lines 16-17, FIGS. 1,2) and has a curved section defining a rounded ceiling and substantially vertical side walls (specification, page 4, lines 23-24, FIG. 4). The curved section extends from the inner diameter

to the outer diameter (FIG. 1). The ceiling is concave in a cross-section perpendicular to the side-walls (FIG. 4). A distance between the side-walls is constant from the bottom surface to the curved section (specification, pages 4, line 30 – page 5, line 2). The outer diameter surface includes a ledge (e.g. ledge 140). A height of at least one of the vertical side-walls is substantially the same as a height of the ledge (specification, page 4, lines 29-30, FIGS 2, 3).

Claim 19 is directed to a carrier head (specification, page 3, lines 21-32) including a substrate receiving surface (specification, page 3, lines 21-32) and a generally annular retaining ring (e.g. retaining ring 100) surrounding the substrate receiving surface. The retaining ring has a top surface (e.g. surface 118), a bottom surface (e.g. surface 112), an inner diameter surface (e.g. surface 114), and an outer diameter surface (e.g. surface 116). The bottom surface includes a plurality of channels (e.g. grooves 130; specification, page 4, lines 12-18). Each channel extends from the inner diameter surface to the outer diameter surface (specification, page 4, lines 16-17, FIGS. 1,2) and has a curved section defining a rounded ceiling and substantially vertical side walls (specification, page 4, lines 23-24, FIG. 4). The curved section extends from the inner diameter to the outer diameter (FIG. 1). The ceiling is concave in a cross-section perpendicular to the side-walls (FIG. 4). A distance between the side-walls is constant from the bottom surface to the curved section (specification, pages 4, line 30 – page 5, line 2). The outer diameter surface includes a ledge (e.g. ledge 140). A height of at least one of the vertical side-walls is substantially the same as a height of the ledge (specification, page 4, lines 29-30, FIGS 2, 3).

Claim 20 is directed to a method of polishing including creating relative motion between a substrate and a polishing surface, restraining the substrate with a retaining ring (specification, page 4, lines 9-11), and supplying a polishing liquid to the polishing surface so that the polishing liquid flows through the channels and beneath the retaining ring to the substrate (specification, page 4, lines 14-15). The retaining ring has a top surface (e.g. surface 118), a bottom surface (e.g. surface 112), an inner diameter surface (e.g. surface 114), and an outer diameter surface (e.g. surface 116). The bottom surface includes a plurality of channels (e.g. grooves 130; specification, page 4, lines 12-18). Each channel extends from the inner diameter surface to the outer diameter surface (specification, page 4, lines 16-17, FIGS. 1,2) and has a curved section

defining a rounded ceiling and substantially vertical side walls (specification, page 4, lines 23-24, FIG. 4). The curved section extends from the inner diameter to the outer diameter (FIG. 1). The ceiling is concave in a cross-section perpendicular to the side-walls (FIG. 4). A distance between the side-walls is constant from the bottom surface to the curved section (specification, pages 4, line 30 – page 5, line 2). The outer diameter surface includes a ledge (e.g. ledge 140). A height of at least one of the vertical side-walls is substantially the same as a height of the ledge (specification, page 4, lines 29-30, FIGS 2, 3).

(6) Grounds of Rejection to be Reviewed on Appeal

Claims 1-5, 7-8, 13, and 18-22 were rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Publication No. 2005/0113002 (“Chen”) in view of U.S. Patent No. 6,280,306 (“Hosoki”).

Claims 1-3, 7-8, 10-13, 18-20, and 22 were rejected under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Patent No. 6,419,567 (“Glashauser”) in view of Hosoki.

Claim 9 was rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Chen in view of Hosoki or over Glashauser in view of Hosoki.

Claims 11 and 14-17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over (Glashauser or Chen) in view of Hosoki and in further view of U.S. Publication No. 2003/0070757 (DeMeyer).

(7) Argument

The examiner rejected claims 1-5, 7-8, 13, and 18-22 under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Publication No. 2005/0113002 (“Chen”) in view of U.S. Patent No. 6,280,306 (“Hosoki”).

The applicant's claims 1, 19, and 20, from which all other claims depend, recite that “a height of at least one of the vertical side-walls is substantially the same as a height of the ledge.” Chen describes a retaining ring with channels 304. Further, Hosoki describes a retainer ring 27 with a step portion 27(a). Both Chen and Hosoki are silent regarding a height of a vertical side-wall with respect to a height of a ledge. Even assuming arguendo that Chen and Hosoki were

combined, the Examiner has not provided a clear reason to adjust the height of Chen's channels or Hosoki's step portion to be substantially the same.

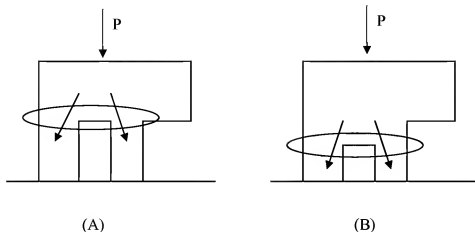
As noted in the M.P.E.P., "[t]he key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious." M.P.E.P. § 2143, Rev. 6, September 2007. As the Supreme Court has noted, "rejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reason with some rational underpinning to support the legal conclusion of obviousness." *KSR*, 127 S.Ct. 1727 (May 3, 2007) (quoting *In re Kahn*, 41 F.3d 977, 988 (Fed. Cir. 2006)).

The examiner argues that motivation to design the retaining ring wherein a height of at least one of the vertical side-walls is substantially the same as a height of the ledge is "so that the sidewalls will be flush with the ledge and decrease a change in force at the junction of the ledge and side-walls, thus maintaining force of the ring and thus uniform support/treatment of the wafer." The examiner's states in the Advisory Action that "force is synonymous with pressure." The applicant does not understand this reason or its underpinning.

First, it not clear what the examiner considers to be applying the force (or pressure) or what direction the force (or pressure) is applied. Is the Examiner referring to a downward force from the carrier head? To an upward force from the polishing pad? To a lateral force from a wafer? To a frictional force from the polishing pad? Applicant assumes that the Examiner is discussing a force that is applied to the retaining ring, but even this is unclear.

Second, the Examiner's statement that decreasing a change in force at the junction of the ledge and side-walls will maintain the force of the ring and thus uniform support/treatment of the wafer is similarly opaque. There is no evidence or articulated reason to suggest that the force (or pressure) of the ring and/or uniform treatment of the wafer would be affected by a change in force (or pressure) at the junction of the ledge and sidewalls.

Third, assuming *arguendo* that the Examiner is discussing distribution of force from the carrier head on the retaining ring, the Examiner's own stated reason would lead away from the invention. In general, the steepest gradients in pressure distribution in a body should be focused in regions where the apertures or gaps are located. This is shown in the following pictures.



As shown in (A), assuming a downward pressure P is applied to a retaining ring with a channel supported on a polishing pad, redistribution of the pressure into the two sidewall portions on opposite sides of the channel should occur generally in the circled region, and thus the circled region, near junction of the ledge with the sidewalls, should be the region with the greatest changes in pressure. If the goal were to decrease a change in downward pressure applied by the carrier head at the junction of the ledge and the sidewalls, then as shown in (B), the channel height should be reduced rather than made equal to the height of the ledge.

For the reasons set forth above, Applicant submits that the Examiner has not put forth an articulated reason with some rational underpinning to support the legal conclusion of obviousness.

The examiner further argues that "it would have been [an] obvious matter of design choice to provide a retaining ring of the optimal support and treatment of the wafer." However, the applicant respectfully submits that the examiner's line of reasoning here is likewise specious. Design optimization of a retaining ring might give a particular height to a channel and/or ledge. Such optimization would not, however, lead a person having ordinary skill in the art to set the heights equal. Moreover, as noted in the MPEP, "only result-effective variables can be optimized" for the purposes of an obviousness rejection. M.P.E.P. §§ 2141.02, 2144.05. The Examiner has not shown that the height of the channel is a result-effective variable.

For at least these reasons, the applicant submits that the examiner has not met her burden of establishing a *prima facie* case of obviousness for independent claims 1, 19, and 20. Further,

the applicant submits that claims 2-5, 7-8, 13, 18, and 21-22 are not obvious at least by virtue of their dependency.

The examiner further rejected claims 1-3, 7-8, 10-13, 18-20, and 22 under 35 U.S.C. § 103(a) as allegedly being obvious over U.S. Patent No. 6,419,567 ("Glashauser") in view of Hosoki.

Glashauser describes a retaining ring with a partially open chamber 350 (FIG. 8F). However, the partially open chamber of Glashauser does not extend "from the inner diameter surface to the outer diameter" as recited in independent claims 1 and 19-29. Further, Glashauser describes a single partially open chamber on a retaining ring and does not describe "a plurality of channels" as recited in claims 1 and 19-20. Hosoki does not cure either of these deficiencies. Moreover, although Hosoki describes a retaining ring with a step portion, neither Glashauser nor Hosoki recites that "a height of at least one of the vertical side-walls is substantially the same as a height of the ledge." Even assuming *arguendo* that Glashauser shows channels and that Glashauser and Hosoki were combined, the examiner has not put forth an underpinned reason to adjust the "channels" of Glashauser or the step portion of Hosoki be substantially the same. Rather, the examiner has repeated the arguments put forth with respect to the combination of Chen and Hosoki, which, as discussed above, do not establish a *prima facie* case of obviousness.

For at least these reasons, the applicant submits that the examiner has not met her burden of establishing a *prima facie* case of obviousness for independent claims 1, 19, and 20. Further, the applicant submits that claims 2-3, 8, 10-13, 18, and 22 are not obvious at least by virtue of their dependency.

The examiner rejected claim 9 under 35 U.S.C. § 103(a) as allegedly being obvious over Chen in view of Hosoki or over Glashauser in view of Hosoki. As discussed above, none of Chen, Glashauser, nor Hosoki teaches that "a height of at least one of the vertical side-walls is substantially the same as a height of the ledge" as recited in claim 1. Further, the examiner has not put forth an underpinned reason for adjusting the heights to be substantially equivalent. Thus, claim 9 is not obvious at least by virtue of its dependency on claim 1.

The examiner rejected claims 11 and 14-17 under 35 U.S.C. § 103(a) as being unpatentable over (Glashauser or Chen) in view of Hosoki and in further view of U.S. Publication No. 2003/0070757 (DeMeyer). As discussed above, none of Chen, Glashauser, nor

Hosoki teaches that "a height of at least one of the vertical side-walls is substantially the same as a height of the ledge" as recited in claim 1. Further, the examiner has not put forth an underpinned reason for adjusting the heights to be substantially equivalent. DeMeyer does not cure these deficiencies. Thus, claims 11 and 14-17 are not obvious at least by virtue of their dependency on claim 1.

The applicant thus submits that pending claims 1-5, 7, 9-11, and 13-22 are in proper condition for allowance. The brief fee and one-month extension of time fee are being paid concurrently herewith on the Electronic Filing System (EFS) by way of Deposit Account authorization. Please apply any other credits or charges to Deposit Account No. 06-1050.

Respectfully submitted,

Date: June 12, 2009 _____

/David Goren/
David J. Goren
Reg. No. 34,609

Customer No. 26185
Fish & Richardson P.C.
Telephone: (650) 839-5070
Facsimile: (877) 769-7945

Appendix of Claims

1. A retaining ring comprising:

a generally annular body having a top surface, a bottom surface, an inner diameter surface, and an outer diameter surface, wherein the bottom surface includes a plurality of channels, each channel extending from the inner diameter surface to the outer diameter surface and having a curved section defining a rounded ceiling and substantially vertical side walls, wherein the curved section extends from the inner diameter to the outer diameter and the ceiling is concave in a cross-section perpendicular to the side-walls, a distance between the side-walls is constant from the bottom surface to the curved section and the outer diameter surface includes a ledge and a height of at least one of the vertical side-walls is substantially the same as a height of the ledge.
2. The retaining ring of claim 1, wherein the rounded ceiling has a semi-circular cross-section.
3. The retaining ring of claim 2, wherein the semi-circular cross-section has a diameter about equal to a width of the channel.
4. The retaining ring of claim 1, wherein the rounded ceiling has a flat portion.
5. The retaining ring of claim 4, wherein the rounded ceiling is rounded at an intersection of the flat portion and the vertical side-walls of the channel.

6. (Cancelled)
7. The retaining ring of claim 1, wherein the plurality of channels have substantially uniform depth.
8. The retaining ring of claim 1, wherein the plurality of channels are oriented at an angle relative to a radial segment extending through the center of the retaining ring.
9. The retaining ring of claim 8, wherein the angle is between 30° and 60°.
10. (Cancelled)
11. The retaining ring of claim 1, wherein the outer diameter surface includes a first portion adjacent the bottom surface that has an outer diameter less than a second portion adjacent the top surface.
12. (Cancelled)
13. The retaining ring of claim 1, wherein the annular body comprises a wearable material.

14. The retaining ring of claim 1, wherein the annular body comprises an upper portion and a lower portion, the upper portion being more rigid than the lower portion.

15. The retaining ring of claim 14, wherein the channels are formed in the lower portion.

16. The retaining ring of claim 15, wherein the lower portion is formed of a wearable material.

17. The retaining ring of claim 15, further comprising a plurality of passages extending through the upper portion from the inner diameter surface to the outer diameter surface.

18. The retaining ring of claim 1, wherein the plurality of channels are distributed at substantially equal angular intervals around the retaining ring.

19. A carrier head comprising:
a substrate receiving surface; and
a generally annular retaining ring surrounding the substrate receiving surface, the retaining ring having a top surface, a bottom surface, an inner diameter surface, and an outer diameter surface, wherein the bottom surface includes a plurality of channels, each channel extending from the inner diameter surface to the outer diameter surface and having a curved

section defining a rounded ceiling and substantially vertical side walls, wherein the curved section extends from the inner diameter to the outer diameter and the ceiling is concave in a cross-section perpendicular to the side-walls, a distance between the side-walls is constant from the bottom surface to the curved section and the outer diameter surface includes a ledge and a height of at least one of the vertical side-walls is substantially the same as a height of the ledge.

20. A method of polishing, comprising:

creating relative motion between a substrate and a polishing surface;

restraining the substrate with a retaining ring that has a top surface, a bottom surface, an inner diameter surface, and an outer diameter surface, wherein the bottom surface includes a plurality of channels, each channel extending from the inner diameter surface to the outer diameter surface and having a curved section defining a rounded ceiling and substantially vertical side-walls, wherein the curved section extends from the inner diameter to the outer diameter and the ceiling is concave in a cross-section perpendicular to the side-walls, a distance between the side-walls is constant from the bottom surface to the curved section and the outer diameter surface includes a ledge and a height of at least one of the vertical side-walls is substantially the same as a height of the ledge; and

supplying a polishing liquid to the polishing surface so that the polishing liquid flows through the channels and beneath the retaining ring to the substrate.

21. The retaining ring of claim 1, wherein the side-walls of each channel are parallel to one another for a depth of at least 0.030 inches.

22. The retaining ring of claim 1, wherein a height of at least one of the side-walls is greater than a depth of the curved section.

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Evidence Appendix

None.

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Related Proceedings Appendix of Claims

None.